RESULTS OF THE RAY E. LEMLEY EXPEDITIONS, PART 1. THE ALLINGHAM FORMATION AND A NEW PLIOCENE VERTEBRATE FAUNA FROM NORTHERN QUEENSLAND

MICHAEL ARCHER and MARY WADE
Queensland Museum

ABSTRACT

The Allingham Formation, a lake and stream deposit with a rich fauna of fossil vertebrates, contains some boulders of basalt. It is paraconformably overlain by part of the earliest known phase of the Nulla Basalt, the Allensleigh 'flow' which has given dates varying from 4·5 to 4 Myr. The fossiliferous deposit may result from damming by early flows and fit stratigraphically between the earliest and main flows of the Allensleigh Phase. The age is thus Lower Pliocene, and the fauna is significant for correlation as well as containing the first known occurrence of *Perameles allinghamensis* n. sp., *Phascolonus lemleyi* n. sp., and *Koobor jimbarratti* n. gen and sp. The fauna, referred to as the Bluff Downs local fauna, is similar to but apparently slightly older than the Chinchilla local fauna. This assessment is based on a consideration of the structurally more ancestral character of some of the Bluff Downs species. This supports the suggestion of Bartholomai (1972) that the Chinchilla local fauna is late Pliocene in age. Faunal differences from comparable Kalimnan faunas such as the Hamilton and Kanunka local faunas are attributed to slight age differences, different geographical or ecological settings, or different modes of accumulation.

Fossil bones were discovered, collected, and reported to the Queensland Museum in 1973 by Messrs J. Barratt and W. Snewin of Ayr. Following information from Mr Barratt that the outcrop underlay basalt, Museum collecting trips were made to the area in 1973 and 1974; both parties were ably assisted by Mr Barratt. Dr Ray E. Lemley participated in and helped to finance the second trip. Specimens described below are deposited in the Queensland Museum.

The geology is the joint responsibility of both authors. The taxonomic work has been carried out by Archer.

THE ALLINGHAM FORMATION

The name Allingham Formation is proposed here for the sequence of terrigenous clays, silts, sands, calcareous sands, and *Chara* limestones underlying the Allensleigh 'flow' of the Nulla Basalt, overlying laterite, and outcropping on Bluff Downs Stn, along the banks of Allingham Creek (at Lat. 19° 43′S, Long. 145° 36′E) a tributary of the Burdekin River, north Queensland. The type section (position indicated in Fig. 1A, B, and strati-

graphic columns detailed in Fig. 2) is the western end of the most extensive outcrop, on the north bank of Allingham Creek, 5·6 km west of Emu Valley Homestead. The name Allingham Formation is in reference to Allingham Creek. The thickness at the type section, which is also the most extensive vertical outcrop observed, is 18 metres.

As indicated in Fig. 2, lateritic detritus is present in whatever portion of the Allingham Formation overlies the laterite. At and adjacent to the type section this largely detrital bed has an independent character (Fig. 1B, a; Fig. 2, a). Here it is a fine ochraceous sediment with laterite clasts and light-coloured component which is now decalcified apart from one thin lens of *Chara* limestone (Fig. 2, section 2); its upper part is a claystone of titurated laterite which grades upward into a grey sandy silt, which is the base of a series of sands and silts (Fig. 1B, b; Fig. 2, b). These beds change upward again gradationally, into sandy *Chara* limestone (Fig. 1B, c; Fig. 2, c) with rare patches of secondary slicification, which in turn grades up into sands and clays (Fig. 1B, d; Fig. 2, d). In creeks at the north end of the amphitheatre (Fig. 1A), 0·2 km north of Allingham Creek, a brownish-grey clay is the
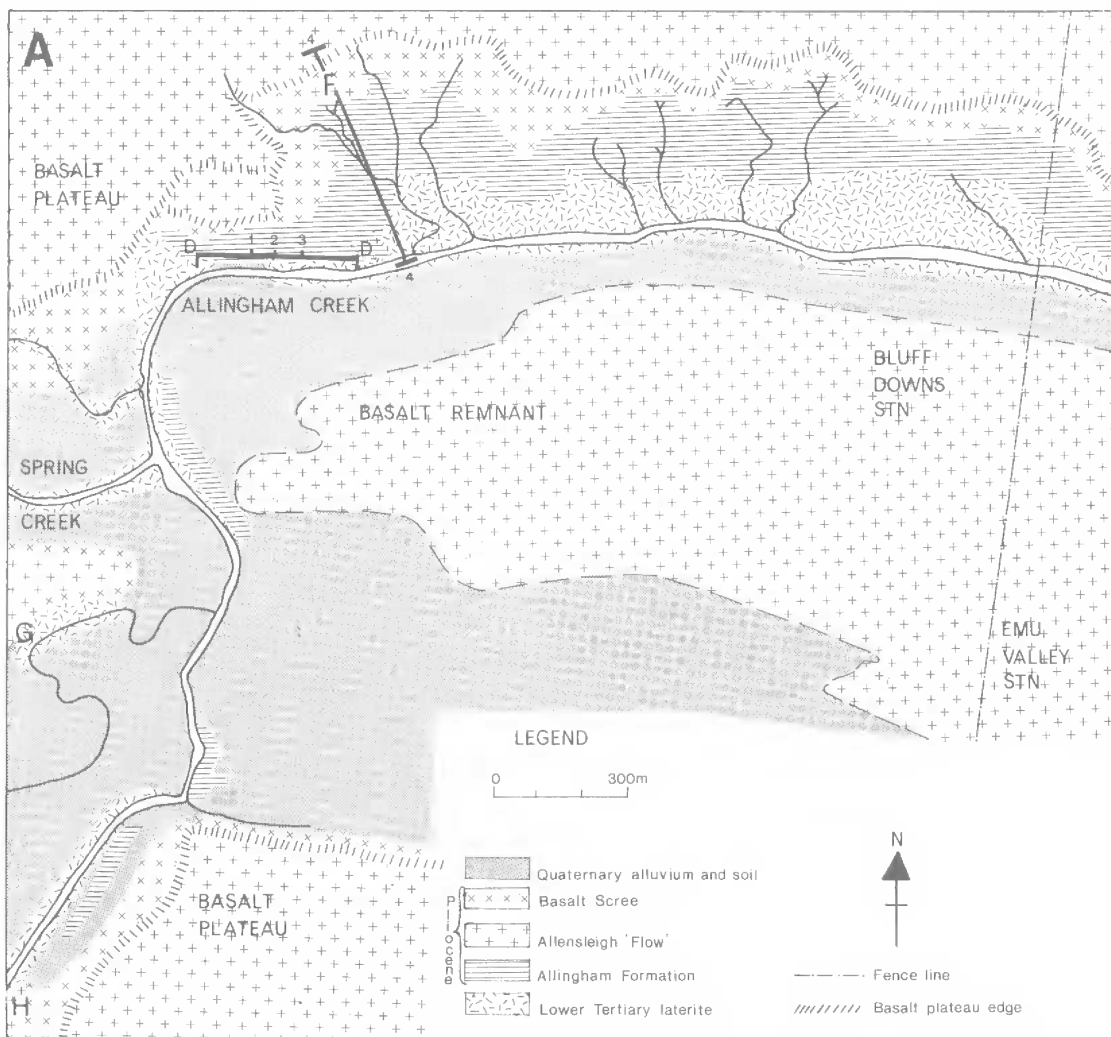
FIG. 1A: Locality plan of Allingham Creek showing type section (D–D) of Allingham Formation. F–H = exposed contacts of Allensleigh flow with: F, Allingham Formation; G, H, laterite mottled zone. Line D–D indicates position of largest cliff exposure of Allingham Formation with 1–3, positions of sections. Details of section stratigraphy shown in Fig. 2. Line 4–4 indicates non-vertical transect which is presented as vertical section 4–4 in Fig. 2.
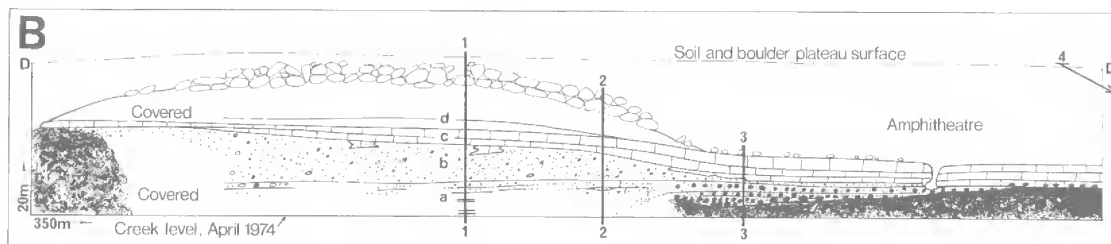

FIG. 1B: Face of cliff exposure (D–D of Fig. 1A) along Allingham Creek, type section. Positions of sections (1–3) are also shown. The laterite basement is deeply eroded and the sediments filling the hollows (bed a) contains much more laterite detritus than overlying beds (b–d). Stratigraphic positions of a–d are also indidated in Fig. 2.
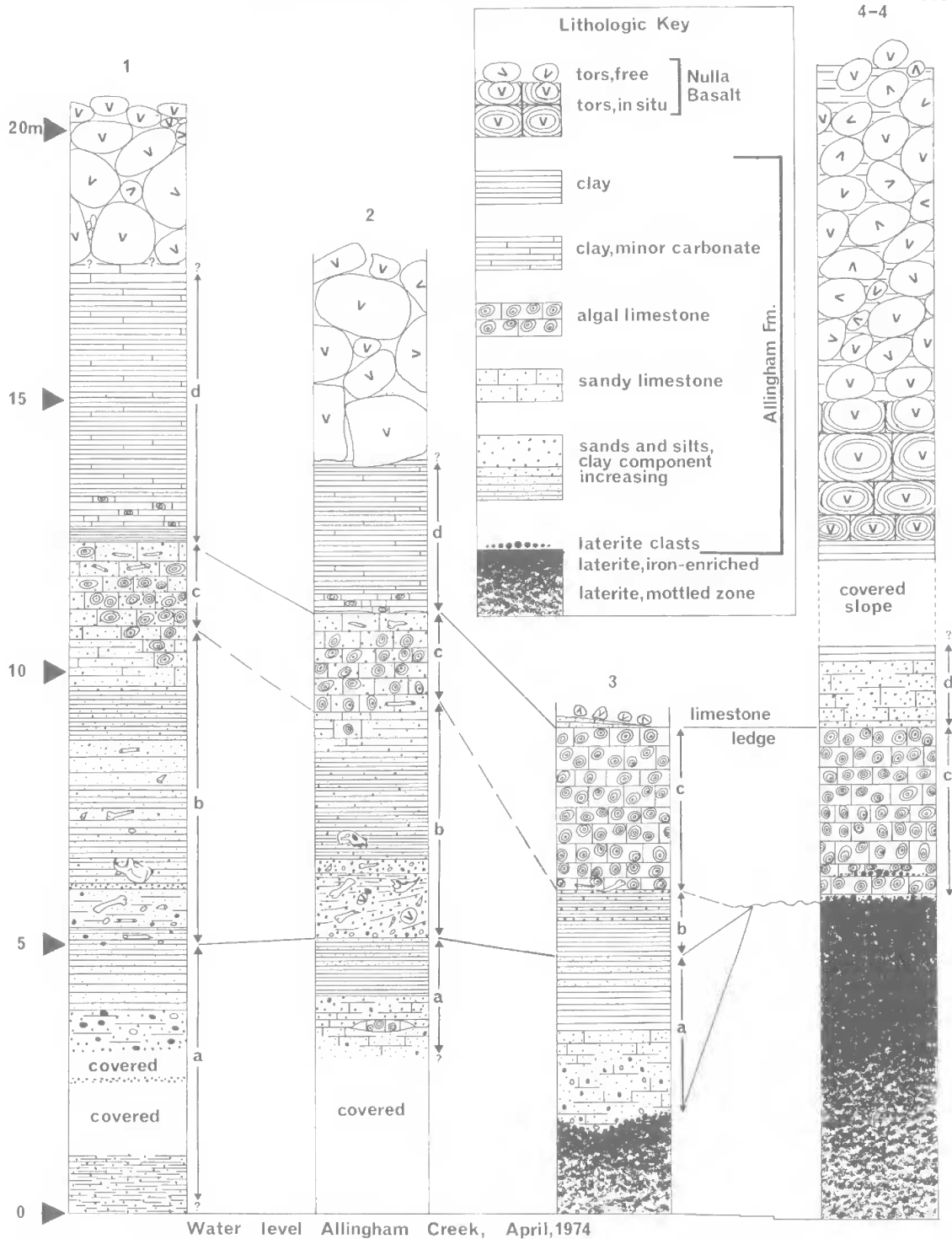
FIG. 2: Stratigraphic sections (1–3) of Allingham Formation along face of cliff exposure (D–D of Fig. 1A) or interpreted (4–4) from exposures along transect (4–4, Fig. 1A) north and east of cliff exposure. Vertical sections 1–3 and lower part of 4–4 were measured; the upper gently sloping part of section 4–4 was estimated. Beds a–d are informal designations of similar lithology. The top of bed d in section 1 and section 2 has not been observed because it is covered by basalt tors. The base of bed a is partly below the water level of Allingham Creek.

uppermost of the horizontal beds of the Allingham Formation. This is not likely to represent volcanic ash as it does not occur in the type section along Allingham Creek (Fig. IB).

The general area has been described by Wyatt and Webb (1970) in the course of mapping and dating the flows of the Nulla Basalt (see also Wyatt 1968, 1969; Wyatt *et al*. 1965, geological map). The fossil occurrence on the eastern extremity of Bluff Downs station was straddled by traverses, and its area mapped by photo interpretation (Wyatt and Webb 1970, fig. 1) as covered by the Allensleigh 'flow'. Here Allingham Creek has cut through the basalt and the fossiliferous deposit into the widespread and deep laterite that Wyatt and Webb describe as basement in Basalt River just to the north. They correlate this laterite with the widespread and deep laterite that Exon, Langsford-Smith and McDougall (1970) date as older than basalts of 23 ± 1 million years, in an area running north from Amby to the level of Injune. In the area exposed by Allingham Creek there is a trend for the more westerly exposures of laterite to be stripped to mottled zone, while more easterly exposures have a varying thickness of iron-rich laterite crust preserved. Surface irregularity was several metres and at the northwesternmost exposure the fossiliferous beds wedge out between the laterite mottled zone and the basalt. To the north and east a ledge-forming *Chara* limestone forms most of the fossil beds and has been traced continuously for 3 km east of the main fossil localities. The top of the bed approximates the 1100′ contour throughout its known extent (contours from Hillgrove 1:100,000 military map series R631, sheet 8058). It extends further than it was followed, and has been observed as an outlier on the road 1 km NE. of Emu Valley Homestead, another 4 km to the east, lying directly on laterite weathering to buckshot gravel. In this spot the Allensleigh 'flow' is reduced to loose boulders. This is probably the outcrop of limestone Wyatt (1969, p. 302) describes as '. . . on the track to Emu Valley Homestead . . .' and likens to '. . . that which occurs as old lake or swamp deposits west of Eumara Springs Homestead . . .' without giving distances or stratigraphic data. The latter locality is not specifically mentioned by Wyatt and Webb (1970) and must be relocated to find its relationship to the Allensleigh 'flow'.

In the Allingham Creek area on Bluff Downs, the Allensleigh 'flow' is usually seen as a jumble of small tors overlying the fossiliferous sediments or the lateritic basement. Original contacts have been noted in three places (Fig. 1A, F–H). In all three, deep tor weathering has occurred but, without the physical removal of weathered material from between the tors, ground water still continues its attack. The continuous basalt is now much more deeply weathered than the free tors. In the absence of erosion surfaces or other divisions between them, this physico-chemical explanation for the differential weathering seems more likely than differing ages, especially as two of these occurrences occupy lows in the lateritic basement (south and west of the fossiliferous deposits) and one overlies the fossiliferous deposit. Wyatt (1969) reached a similar conclusion studying exposures to the north, notably in Basalt River. At the back of the shallow amphitheatre surrounding the outcrop shown in Fig. 1A, F; Fig. 2, 4—4, the strongly weathered basalt lies conformably on a brownish-grey clay overlying a metre of limey sand which in turn grades into 3 metres of hard *Chara* limestone. This limestone unconformably overlies iron-enriched laterite crust and has a basal conglomerate of buckshot gravel and finer laterite detritus. Traced westwards, along Allingham Creek, the limestone overlies laterite mottled zone and much of it changes laterally to sands and clays. Some of these are channel deposits which contain a minor amount of basalt as boulders and pebbles. These must indicate a basalt earlier than the Allensleigh 'flow' or the early extrusion of part of the 'flow'. Wyatt and Webb have already stated that the datings obtained on this 'flow' range from 4·5 Myr, 10 km WNW. near Bluff Downs Homestead, to 4 Myr further north (both datings $\pm$ 3%). They suggest the 'flow' may more properly be regarded as a flow series with a span of at least half a million years. The presence of basalt boulders in sediment underlying the main flow lends weight to their suggestion but does not rule out an earlier phase of the Nulla Basalt, possibly of minor extent. Neither interpretation is at variance with the visual evidence of conformity between the top of the fossiliferous sediment and the local base of the Allensleigh Phase. The fossiliferous sediment is thus dated as no less than $4 \pm \cdot 12$ Myr and not much older, i.e. Lower Pliocene (Harland, Gilbert Smith, and Wilcock 1964; Riedel 1973).

Observation of the lateral extent of the fossiliferous beds is hampered by the basalt cover and by Pleistocene channel deposits related to a roughly parallel course of Allingham Creek, which cut the deposit in two. The fossiliferous beds are probably an age-equivalent to the unconsolidated sands below the Allensleigh Phase at Eumara Springs (Wyatt and Webb 1970, pp. 40, 47). These are roughly 30 m lower than the fossiliferous beds, and 24 km to the east of the outlier on Emu Valley road. Both also could be age-equivalents of the Campaspe Beds, which are poorly dated, if the older of

the possible dates Wyatt and Webb suggest applies to the Campaspe Beds; even if this should be so, the deposits were not in lateral continuity and the strong limestone component provided by the growth of *Chara* gives the fossiliferous deposits described here a distinctive lithology over most of their outcrop.

Apart from the cliff containing the type section, outcrops of the terrigenous lower members of the Allingham Formation (a and b) are confined to the southern to eastern side of Allingham Creek and to its bed. The easternmost terrigenous outcrop yet found is 1 km west of the Emu Valley–Bluff Downs boundary fence and lies on lateritic mottled zone. It may have been covered directly by the basalt as its top is indurated, but erosion has removed an upper contact. A major outcrop, capped by *Chara* limestone, runs south from opposite the entry of Spring Creek, a western tributary, for about 300 m. This outcrop contains a very strongly calcareous development of bed c, *Chara* limestone in close-packed lenses. Here the limestone laterally replaces sand, both lateral equivalents overlying 0·5 m of derived laterite lying on laterite mottled zone *in situ*. The remaining southern outcrop is from 1 to 1·4 km south of the type section, and is fossiliferous sands and clays overlain by basalt. Outcrops in the creek bed are of a temporary nature due to shifting alluvium. They occupy pockets in the laterite.

The conditions of deposition indicated by the sediments show that the laterite surface was partly stripped and deeply gouged, before its flooding by water sufficiently permanent both to accumulate sediment and allow the growth of the widespread *Chara* flora. This flora, together with waterlaid sands, clays and channel deposits, suggests that an existent stream widened into a shallow lake. Animal fossils are relatively rare in the widespread limestone and are mainly scattered tortoise plates. In contrast, the terrigenous sediments contain many broken bones, some complete bones and skulls, and rarely articulated bones. By far the most common fossils throughout are scattered tortoise plates and crocodile teeth. Fish remains are relatively rare, which may indicate a seasonal constriction of the water body. Then, as now, the area sloped gently eastward (Wyatt and Webb 1970), and evidence of diastrophism, other than that provided by partial stripping of the laterite, is lacking. The cause of this erosion is scarcely likely to have been the damming mechanism which started deposition. The presence of a limited amount of basalt in some of the channel deposits suggests another mechanism, damming by a more easterly flow or portion of a flow, than supplied the basalt boulders.

BLUFF DOWNS LOCAL FAUNA
Michael Archer

The Bluff Downs local fauna is described below and may be summarized as follows. Dental terminology follows that used by Archer (1974, 1975a). Local fauna refers to a faunal assemblage from a particular area in the sense used by Tedford (1970); it is an informal term. Prefixes to specimen numbers include AM, Australian Museum; WAM, Western Australian Museum; J or JM, Queensland Museum modern specimens; F, Queensland Museum fossil specimens.

ARTHROPODA
  Crustacea
    Unidentified gastrolith
OSTEICHTHYS
  Teleostei
    Unidentified spines and vertebrae
REPTILIA
  ?Cheliidae
    ?Chelodina sp.
  Crocodilidae
    Palimnarchus sp.
  Agamidae
    Small unidentified agamid similar to *Amphibolurus* spp.
  Varanidae
    Varanus sp.
  Boidae
    ?Morelia sp.
  ?Elapidae
    Small vertebrae
AVES
  Ciconiidae
    Xenorhynchus asiaticus (Lathan, 1790)
MAMMALIA
  Peramelidae
    Perameles allinghamensis n. sp.
  Vombatidae
    Phascolonus lemleyi n. sp.
  Phascolarctidae
    Koobor jimbarratti n. gen. and sp.
  Thylacoleonidae
    Thylacoleo sp.
  Macropodidae
    Protemnodon sp.
    Macropus sp. cf. *M. dryas* (De Vis, 1895)
    M. (Osphranter) sp. cf. *M. woodsi* Bartholomai, 1975
    Macropodid similar to *Thylogale*
    Small macropodid, genus indet.
  Diprotodontidae
    Zygomaturus sp.
    Euryzygoma sp.
    Nototheriine, genus indet.
  Unidentified families
    One tooth fragment
    Coprolites

SYSTEMATICS

ARTHROPODA

CRUSTACEA
(Plate 54f)

F7829 represents a crustacean gastrolith, the only specimen recovered.

OSTEICHTHYS

TELEOSTEI
(Plate 54a–b)

Fish spines (e.g. F7771) and vertebrae (e.g. F7772) are small and relatively uncommon. The largest vertebra is only 7 mm in diameter and the largest spine is 25 mm long.

REPTILIA

?CHELIIDAE

Fragments of tortoises were the most common fossils. These cannot at present be referred with any certainty to a particular species or even genus. A comparison of various Allingham fragments with materials described by De Vis (1894, 1897) as *Chelymys uberrima*, *C. arata* and *Chelodina insculpta* show some similarities. A fragment (F7796) possibly referable to *Chelodina* exhibits curious pock-markings, presumably the result of disease or invertebrate predation.

CROCODILIDAE

Crocodilian teeth are the next most common vertebrate remains. Variation in form and size is considerable and it is possible that more than one species is represented. As well as teeth there are large crocodilian vertebrae, limb bones, scutes and skull fragments.

Palimnarchus sp.
(Plate 54 c–e)

Large compressed teeth (e.g. F7763, Plate 54d) with serrated edges probably represent a species of this genus. Almost identical teeth occur in the Chinchilla Sand. Some Allingham teeth (e.g. F7764, Plate 54e), show occlusal wear, a not uncommon characteristic of *Palimnarchus* (M. Hecht, pers. comm.).

Several small crocodile teeth (e.g. F7767, Plate 54c) exhibit extensive vertical fluting. In *Crocodilus johnstoni*, this feature is common in most teeth. In *C. porosus* it sometimes occurs on smaller but not larger teeth. It may similarly have occurred on some teeth of *Palimnarchus*, and cannot be used to distinguish a second taxon unless associated material proves distinctive. Longman (1924) describes *C. nathani* from fossil material found at Tara Creek, Maryvale Station, north Queensland. This species is dubiously distinct from *Palimnarchus* and no attempt has been made to distinguish it among the Allingham crocodilian remains.

A thorough revision of late Cainozoic crocodilians must be made before all the Allingham crocodile remains can be positively identified.

AGAMIDAE
(Plate 54i)

A small right dentary fragment (F7812) with seven teeth represents an agamid lizard similar to some species of *Amphibolurus*.

VARANIDAE

Varanus sp.
(Plate 54h, j)

At least two vertebrae (F7774, and F7777) represent a species of this lizard genus. A recurved tooth crown (F7813, Plate 54h) may also be referable to *Varanus*. The tooth is 15 mm long and 6 mm wide at the base, somewhat polished by stream-abrasion, without serrations on posterior or anterior cutting edges, and lacks vertical fluting around the crown base.

In modern comparative material of *Varanus* the teeth have very fine serrations on anterior and posterior cutting edges as well as vertically fluted crown bases. In *Megalania prisca*, *Varanus dirus* and *Notiosaurus dentatus* these same characters occur, except that the anterior cutting edge has fewer serrations than the posterior edge.

Fejérvary (1918) refers *Notiosaurus* to *Megalania* and suggests that material previously referred to *V. dirus* may represent two forms: the holotype, which comes from the Darling Downs, possibly representing *Megalania prisca*; the referred specimen, which comes from Chinchilla, representing something else. *Varanus emeritus* is not represented by teeth. Of all these fossil varanids and megalanids the Allingham tooth is most similar to the referred specimen of *V. dirus* from Chinchilla but differs in being less recurved and in lacking the serrations and vertical fluting. Its degree of recurving is matched by some modern *Varanus* (e.g. *V. varius*) and it is possible that if fluting and serrations were fine enough on the Allingham tooth, they could have been removed by abrasion.

The single Allingham tooth is twice the size of teeth of a seven foot specimen of *Varanus salvadorii*, the largest specimen of a species of *Varanus* in

the Queensland Museum. The fossil tooth differs morphologically in having a wider and less slender crown, and a more rounded anterior cutting edge.

One of the Allingham varanid vertebrae (F7774, Plate 54j), a posterior rib-bearing lumbar vertebra (around the 21st or 22nd position), is similarly unique. It compares favourably with vertebrae of *Varanus* species but not *M. prisca*. Vertebrae of megalanids from Chinchilla have not been described. The Allingham vertebra differs from comparably sized vertebrae of *V. salvadorii* in being markedly taller, having an antero-posteriorly shorter neural spine, a pronounced vertical crest on the posterior edge of the neural arch, and sub-rounded, more vertically inclined prezygapophyses.

The other varanid vertebra (F7777), an anterior caudal vertebra of uncertain position, is about equally distinct from modern species of *Varanus*. The ventral pedicels for the haemal arch, the relatively anteriorly situated cotyle, and the relatively reduced neural spine indicate that this vertebra represents a varanid, but the pronounced ventral crest, relatively high neural arch and reduced transverse processes are unmatched by vertebrae of any modern species with which comparison has been made (*V. salvadorii*, *V. varius* and *V. gouldii*).

Boidae
(Plate 54k)

Three vertebrae (including F7775) represent a very large boid, morphologically very similar to modern species of *Morelia*. No comparative material has been available in the size range of this Allingham snake, so minor differences in morphology may be attributed to allometry.

It is difficult and often misleading to estimate sizes of animals based on fragmentary remains, but compared with a 5·3 m specimen of *Morelia spilotes*, the Allingham boid may have been over 6·2 m long. Worrell (1970) notes a record of a modern Australian boid *(Liasis amethistinus)* of 8·7 m. Considering this, the Allingham snake was probably no larger than some modern boids.

?Elapidae
(Plate 54g)

Two small vertebrae (including F7826) may represent elapids. They compare favourably with species of *Pseudechis* but not enough colubrid material has been available to be certain of even the familial identity of these vertebrae.

Aves
Ciconiidae

Xenorhynchus asiaticus (Lathan, 1790)

A fragment of a tarsometatarsus (F7036) represents this modern stork (pers. comm. J. van Tets, 21.i.1974) known as the Blackheaded Stork.

Other bird remains are presently under study by P. Rich.

Mammalia
Peramelidae

Perameles allinghamensis n. sp.
(Fig. 3; Plate 55c)

Holotype: F7821, isolated RM^2; Allingham Formation, Lower Pliocene, site 5, Allingham Creek, Bluff Downs Stn, north Queensland.

Diagnosis: Very large peramelid differing from other species of *Perameles* in having better-developed antero-buccal cingulum; more closely approximated protocone and paracone; paracrista which buccally contacts stB which is posterior to parastylar corner of tooth.

Description: Measurements shown in Fig. 3.

Crown showing slight wear on tips of all cusps. Metacone broken and metastylar corner missing. Tip of hypocone damaged. Anterior cingulum short and complete but just barely so beneath paracrista. Anterior cingulum formed by confluence of antero-buccal cingulum and preprotocrista. Postprotocrista descends to meet on hypocone (or metaconule). Crest leaves hypocone postero-buccally and descends to base of metacone where it forms very short, reduced posterior
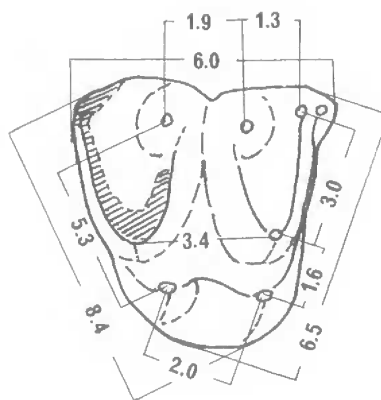

Fig. 3: Measurements (mm) of F7821, RM^2, holotype of *Perameles allinghamensis* n. sp. Hatched area indicates damage.

cingulum before terminating along flank of metacone. Hypocone small and separated from protocone by deep vertical fissure on postero-lingual face of crown. Metacone higher than subequal paracone and protocone which are higher than hypocone. StB shorter than large subequal stC and D. StA indistinguishable from parastylar corner of tooth but short buccal crest links stB with antero-buccal cingulum. This crest may be homologue of stA. Anterior paracrista (homologue of dasyurid paracrista) forms prominent crest linking paracone and stB. Posterior paracrista similarly links paracone and stC. Prominent anterior metacrista links metacone and stD. Posterior metacrista (homologue of dasyurid metacrista) damaged but presumably extended to metastylar corner of tooth. Presence or absence of stE unknown. Prefossa between bases of protocone, paracone and metacone extends to buccal surface of crown. No crest links stC with D. Similarly, no crest links stB with C. StC gently recurved anteriorly. StD gently recurved posteriorly. Ectoloph virtually non-existent as result of failure of stylar cusps to be united by crests. Ectoflexus greatest between stC and D.

This tooth is considered to be an M² because of the size of the stylar cusps, hypocone and relative sizes of the paracone and metacone.

DISCUSSION: Species of *Perameles* available for examination have been *P. nasuta* (e.g. J10816), *P. bougainvillei* (e.g. WAM M10576), *P. eremiana* (WAM M1575), and *P. gunnii* (e.g. AM M2640). This includes all modern species recognized by Ride (1970). Most species of the genera *Microperoryctes, Peroryctes, Echymipera, Isoodon, Chaeropus, Macrotis* and *Ischnodon* have been examined. Photographs of the only known material of *Rhynchomeles* have been made available by courtesy of the British Museum. This includes all modern and fossil perameloid genera recognized by Tate (1948) and Stirton (1955).

P. allinghamensis occupies a somewhat intermediate structural position between *Perameles* and those species of *Echymipera* which have been examined (*E. rufescens*, both subspecies, and *E. kalubu*). As in other species of *Perameles*, stC of *P. allinghamensis* is relatively discrete and conical on M². This is true but to a lesser extent in species of *Echymipera* where stC is sometimes linked to the paracone by a small crest. This latter condition is common and better-developed in other peramelids such as *Peroryctes* and *Microperoryctes*. The anterior cingulum is better-developed in *Echymipera* than it is in *Perameles* and in this respect *P. allinghamensis* resembles *Echymipera*. *P. alling-*

hamensis may be an ancestor of *Perameles, Echymipera*, or both. It is referred here to *Perameles* because of the crest and stylar cusp morphology. When more material is discovered, it is probable that it will warrant generic separation from all modern peramelids.

Other fossil perameloids include *Ischnodon australis* (referred elsewhere to the Thylacomyidae, Archer and Kirsch in preparation); an unnamed peramelid from the Hamilton local fauna (Turnbull and Lundelius 1970) represented by fragments of lower molars; *Perameles tenuirostris* Owen which is regarded by Lydekker (1887) as synonymous with *P. nasuta; P. wombeyensis* which has been synonomized with *Isoodon macrourus* by Wakefield (1972); and an unnamed peramelid from the Fisherman's Cliff local fauna (Marshall 1973) represented by a fragmentary upper molar. There is some doubt about the provenance of this last specimen (Mr P. Crabb, pers. comm.). The possible peramelid noted by Woodburne (1967) from the Miocene Alcoota local fauna now appears to represent a thylacoleonid (Dr W. A. Clemens, pers. comm.).

ORIGIN OF SPECIFIC NAME: The specific name is in reference to the Allingham Formation and Allingham Creek.

VOMBATIDAE

Phascolonus lemley n. sp.
(Fig. 4; Plate 56)

HOLOTYPE: F7819, left dentary with M$_{1-4}$; Allingham Formation, lower Pliocene, site 5, Allingham Creek, Bluff Downs Stn, north Queensland.

REFERRED MATERIAL: F7818, LI$_1$; F7768–70, isolated molars: same locality as holotype.

DIAGNOSIS: Very large vombatid, differing from *Phascolonus gigas* in markedly longer dorso-ventral section of I$_1$; shorter cheek-tooth row; shallower masseteric fossa; smaller and less protruding ventro-lateral rim of masseteric fossa; broader posterior border of dentary below articular condyle; shallower symphysis; and edge of ectocrotaphyte plate and articular condyle which extend relatively farther postero-dorsally. Differs from *Phascolomys magnus* and *P. medius* in being larger; having markedly longer dorso-ventral section of I$_1$; proportionately much longer premolar; and deeper masseteric fossa. Differs from all other vombatids in its much larger size as well as morphological characters.

DESCRIPTION: Measurements shown in Fig. 4.

Dentary broken at point anterior to mental foramen and posterior to I$_1$ alveolus. Coronoid
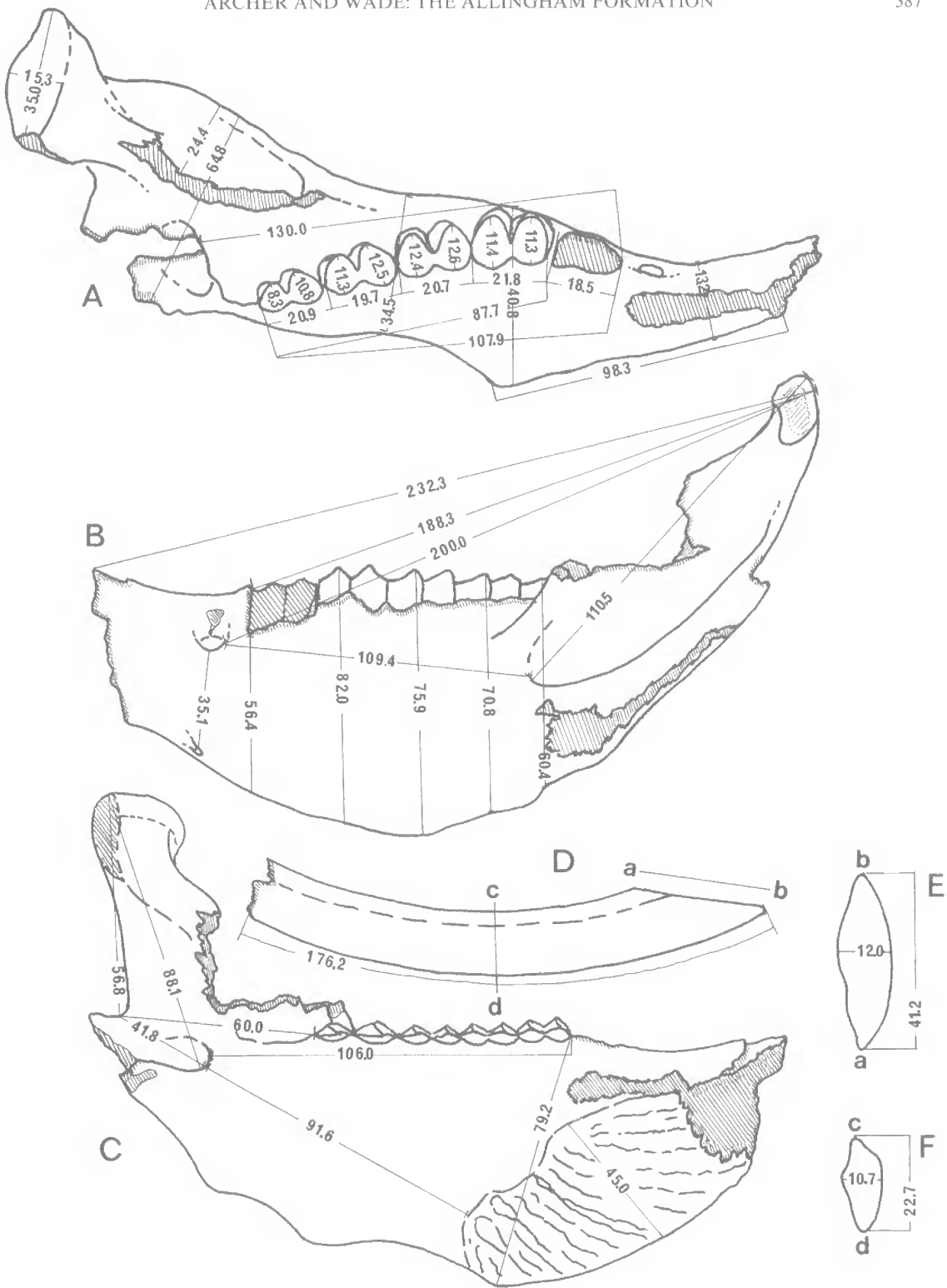
FIG. 4: Measurements (mm) of F7819, holotype of *Phascolonus lemleyi* n. sp., and F7819. A–C, F7819, left dentary with M$_{1-4}$. D, F7818, LI$_1$. Hatched areas indicate damage.

and angular processes broken at bases. Mesial and distal tips of articular condyle broken. I_1 and P_4 missing, although proximity of LI_1 (F7818) to dentary in quarry (less than 20 cm), unabraded condition of open root of I_1 and alveolus of I_1 indicate that isolated I_1 probably drifted out of dentary shortly before burial. Associated with dentary in same quarry 10 cm away was an articulated macropodid hindlimb, suggesting that adjacent objects in quarry may be parts of one individual.

I_1 with flat horizontal occlusal surface. Wear striae on occlusal surface extend antero-posteriorly from anterior tip for distance of 39 cm, presumably distance through which dentary dislocates during thegosis. Prominent ventral keel. Dorsal surface forms narrow shelf which inclines lingually. Prominent depression runs length of I_1 on dorsal-buccal surface. Less pronounced longitudinal striae run length of I_1.

P_4 alveolus indicates tooth had only very shallow medial lingual groove, although there were two poorly differentiated (in comparison with molars) columns. Alveolus length suggests P_4 slightly shorter than M_1.

M_{1-4} markedly divided into two columns, buccal grooves being sharper and more deeply incised than lingual grooves. Talonid (posterior column) wider than trigonid (anterior column) in M_1, subequal in M_{2-3} and narrower than trigonid in M_4. Worn trigonid height subequal to worn talonid height M_{1-2}, but taller than worn talonid M_{3-4}. Talonid length longer than trigonid length M_1 but shorter than trigonid length M_{2-4}.

Dentary massive (but markedly less so than in *P. gigas*). Symphysis extends posteriorly to level of middle of M_2. Base of ascending ramus leaves body of dentary at level of anterior end M_4. Masseteric fossa deep for a vombatid but shallow compared with *P. gigas*. Postalveolar ridge sharply curved postero-laterally and forms dorsal rim of dental canal. Pre-alveolar ridge forms sharp crest which extends as far anteriorly as broken anterior edge of dentary. Ectocrotaphyte plate relatively narrow (compared with *P. gigas*). Mylo-hyoid groove relatively large. Width of superangular cavity (pterygoid fossa) exceeds that of ectocrotaphyte plate. Inferior dental canal has large oriface (mandibular foramen) but rapidly tapers down to small canal. Masseteric foramen very large, almost as large as mandibular foramen.

Ectocrotaphyte ridge and articular condyle extend postero-dorsally farther than they do in material described by Stirling (1913). Posterior neck of dentary below condyle broad and flat,

unlike condition illustrated by Owen (1872, plate 138, fig. 1) but somewhat similar to specimen described as 'Mandible "C"' by Stirling (1913). Compared with Owen's (1872, plate 36, fig. 1) illustration of *P. gigas*, ascending ramus of *P. lemleyi* exhibits longer masseteric fossa, and longer and less-curved border anterior to articular condyle.

DISCUSSION: Wombats of the genus *Phascolonus* (*P. gigas* and *Sceparnodon ramsayi*) have all been placed in the synonymy of *P. gigas* Owen. The taxonomic positions of *medius* Owen and *magnus* Owen are unclear (Tate 1951). In some respects such as size and premolar morphology, they resemble *P. gigas* and make generic boundaries of *Phascolonus* difficult to recognize. Synonymy of *ramsayi* with *P. gigas* enables the generic diagnosis of *Phascolonus* to include widely spatulate upper incisors. Upper incisors of *P. lemleyi* are not yet known, but overall similarity of lower incisors of *P. lemleyi* to those of *P. gigas* suggest the upper incisors are spatulate. Differences in lower incisors of *P. lemleyi* and *P. gigas* include much longer cross-sectional length of the former which results in a relatively longer occlusal wear surface. Possible significance of this is not clear although increase in cross-sectional length of I_1 in other wombats appears to correlate with increase in width of I^1 such as may be observed in a structural sequence from *Vombatus ursinus*, through *Phascolomys magnus*, to *Phascolonus gigas*. If this relationship is maintained in *P. lemleyi*, its upper incisors were not only relatively but absolutely wider than those of *P. gigas*.

A specimen (F834) collected at Freestone Creek, Darling Downs, Queensland, resembles *P. lemleyi* in cross-sectional length of I_1, and length of M_{1-4}. It differs in having a shorter P_4 comparable in size with *magnus*, and raises a question about the number of Pleistocene species of *Phascolonus*. Stephenson (1963) describes *Diarcodon parvus* as a diprotodontid similar to but smaller than *Sceparnodon ramsayi*, which he also regarded as a diprotodontid. There can be no doubt that *Sceparnodon* is a vombatid (Ride 1967) and the diprotodontid affinity of all of the material referred to *D. parvus* is doubtful. Some of the upper incisors may represent a species of *Phascolonus*.

ORIGIN OF SPECIFIC NAME: The specific name is in honour of Dr Ray E. Lemley, Queensland Museum Associate, who very kindly helped us on several occasions by financing and accompanying expeditions.

PHASCOLARCTIDAE

Koobor n. gen.

TYPE SPECIES: *Koobor notabilis* (De Vis) [= *Pseudocheirus notabilis* De Vis 1889].

DIAGNOSIS: Small phascolarctids, similar to *Phascolarctos* but differ in being smaller; lacking extensive fine crenulations on molar crown surface; lacking well-developed pockets or basins between bases of protocone and hypocone; having distinctly shorter and bicuspid P[4] without significant longitudinal crest development; having well-developed basin buccal to paracone between ectoloph, preparacrista and postparacrista; having stylar crests well-developed adjacent to stB; having well-developed gap between stC and stD; and overall crown outline which is relatively longer than wide. Differs from *Litokoala* in having narrower molars; better-developed and enclosed basin buccal to paracone; less crenulations; and no well-developed metaconule. Differs from *Perikoala* (as judged by comparison with fragmentary material described by Stirton, Tedford and Woodburne 1967) by having narrower and less crenulated molars. Differs from *Pseudokoala* and all pseudocheirines (*Pseudocheirus, Pseudochirops, Schoinobates, Petropseudes, Hemibelideus*) in having lingually displaced paracone and metacone; lacking complex or well-developed metaconule on M[1-2]; lacking well-developed protoconule on M[2-3]; having better-developed anterior cusp on P[4]; and having larger gap between stC and stD.

ORIGIN OF GENERIC NAME: Koobor is an Aboriginal mythological Koala-boy who was always so thirsty that he stole his companions water containers and hid with them up a tree. When discovered, he was punished by his enraged companions and turned into the Koala, a creature who thereafter never drank water (Roberts and Mountford 1970).

Koobor jimbarratti n. sp.
(Fig. 5; Plate 55b)

HOLOTYPE: F7822, isolated RM[1 or 2], Allingham Formation, Lower Pliocene, site 5, Allingham Creek, Bluff Downs Stn, north Queensland.

DIAGNOSIS: Differs from *Koobor notabilis* (only other species) in having well-developed parastyle; poorly-developed anterior cingulum; preprotocrista which contacts preparactista; more obtuse angle enclosed by pre- and postmetacristae; and poorly-developed buccal crests at ends of pre- and postmetacristae.

DESCRIPTION: Measurements shown in Fig. 5.

Transverse fracture occurs through tooth. Surface of enamel lightly pitted by chemical erosion. All primary cusps subequal in height. Metacone and hypocone just closer together than paracone and protocone. Preprotocrista contacts base of preparacrista midway along length of preparacrista. Postprotocrista passes postero-buccally to midline of tooth then joins prehypocrista. Posthypocrista passes postero-buccally to form small posterior cingulum before contacting buccal end of postmetacrista. Preparacrista short, markedly curved, and contacts stB. Postparacrista longer, less curved, and contacts stC. Pre- and postparacrista indirectly connected buccally by ectoloph crest connecting stB and stC. Premetacrista straight and runs to position of stD. Postmetacrista straight and runs to metastylar corner of tooth where it connects with upturned posterior cingulum. Low crest on ectoloph from buccal end of premetacrista does not extend posteriorly as far as metastylar corner. No crest connects stC and position of stD. Parastylar crest connects anterior end of preparacrista to parastylar corner of tooth. Below point of contact between preprotocrista and preparacrista, two small vertical crests connect short antero-buccal cingulum to premetacrista and preprotocrista, enclosing very small pocket between them. Antero-buccal cingulum poorly-defined or absent along lingual half of tooth, although basal crown swelling occurs. Shallow basin occurs between bases of protocone and hypocone. Side of tooth between pre- and postmetacristae not enclosed buccally. A lingual crest occurs on metacone extending antero-lingually to midcrown basin.
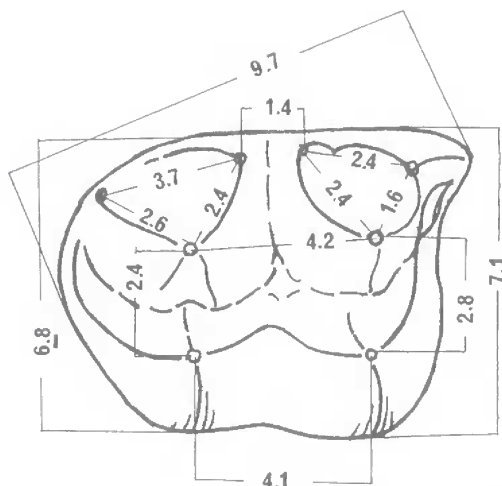

FIG. 5: Measurements (mm) of F7822, RM[1] or RM[2], holotype of *Koobor jimbarratti* n. gen. and sp.

Smaller lingual crest extends postero-lingually from metacone tip to posterior cingular basin. Poorly-developed protocone rib extends buccally from protocone tip to base of metacone. Rib and crest development on paracone and protocone not clear.

DISCUSSION: The species of *Koobor* are clearly not pseudocheirines but they are similar to phascolarctids, and of these, perhaps closest to the middle Miocene *Perikoala*. They may be late Tertiary representatives of the same phascolarctid group. *Litokoala* and *Phascolarctos* are not representatives of this group and may have been independently derived from other Miocene phascolarctids.

The Chinchilla species is better known than the Allingham species and, in some respects such as the better-developed buccal basins, is structurally more advanced.

ORIGIN OF SPECIFIC NAME: *Koobor jimbarratti* is named in honour of Mr Jim Barratt who, with Mr Wally Snewin, originally discovered the fossil sites along Allingham Creek.

THYLACOLEONIDAE

Thylacoleo sp.
(Plate 55a)

MATERIAL: F7762, right dentary fragment with half of P_4 and M_1, roots of I_1, and alveoli for M_1; F7807, posterior fragment of LP_4; F7808, posterior fragment of LP^4.

DISCUSSION: This is a very small species of *Thylacoleo* comparable in size to a form recorded by Merrilees (1968, p. 14) as '*Thylacoleo*, probably not *carnifex*' from a paraconglomerate interpreted by Merrilees to be Pleistocene in age, at Wonberna, near Balladonia, Western Australia. It differs from this form in having a relatively much larger M_1. It is also similar to *T. crassidentatus* from the Pliocene Chinchilla Sand, but differs in having a proportionately much shorter P_4.

Thylacoleonids are separable into at least two distinct types: *Thylacoleo* species, so far known only from Pliocene and younger sediments; and *Wakeleo* species, so far known only from middle to late Miocene sediments. A third type may be represented by an undescribed form from the middle Miocene Etadunna formation. The Allingham form, although clearly referable to *Thylacoleo*, is also similar to *Wakeleo* in so far as it exhibits a relatively short P_4 and large M_1. It is tempting to assume orthogenesis and see the Allingham thylacoleonid as a link in a chain leading directly from *Wakeleo* to *Thylacoleo*. However this type of reasoning is almost always found to be fallacious when the fossil history of a group becomes better known. Indeed, the occurrence of a thylacoleonid with a short P_4 in supposedly Pleistocene deposits at Wonberna is sufficient reason to doubt that premolar length can be directly correlated with time. As in most groups, the late Tertiary radiation of thylacoleonids probably resulted in a complex of forms, each the product of different selective pressures, rather than all being subject to one single pressure, namely an increase in carnassial length at the expense of other cheek-teeth.

MACROPODIDAE

Comments about the forms represented here are only preliminary. Formal descriptions will be given by Archer and Bartholomai (in preparation). There are at least five macropodid species represented, of which four can be assigned to genera: *Protemnodon* sp.; *Macropus* cf. *M. dryas; Macropus (Osphranter)* sp.; and ?*Thylogale* sp. Concepts of Chinchilla species of *Macropus* employed here are those of Bartholomai (1975).

Protemnodon sp.
(Plate 57a–b)

A maxilla (F7810), fragmentary upper premolar (F7814), isolated molars (e.g. F7809), and a dentary with dP_3 and M_1 (F7812) represent a small species of this genus. It is most similar in morphology to *P. chinchillaensis* and *P. devisi* from the Pliocene Chinchilla Sand and *P. otibandus* from the Pliocene Otibanda Formation. The upper molars of the maxillary fragment (F7810) differ from those of *P. devisi* in being smaller; lacking a lingual cingulum between the bases of the protocone and hypocone; having a less well-developed midlink, and a better-developed posterior pocket. They differ from *P. chinchillaensis* in having a wider metaloph on M^4 and a less well-developed midlink. Overall, they most closely resemble *P. chinchillaensis*. An isolated RM^4 (F7811) is even more similar to those of *P. chinchillaensis* than is the M^4 of F7810. It has a comparably developed midlink and a very narrow metaloph. The isolated RP^4 fragment (F7814) is relatively narrow and shows other differences that appear to distinguish it from *P. chinchillaensis*. Considering variation in premolar morphology shown by Bartholomai (1973), these differences may not be significant. DP_3 (F7812) however, appears to be markedly different from that tooth in *P. chinchillaensis* as well as *P. devisi*. The protoconid is either absent or in-

distinguishable from the metaconid, and the buccal side of the trigonid is incised by a prominent vertical fissure. There is also a buccal cingulum between the bases of the trigonid and talonid. It is possible that this single tooth is abnormal. Comparably unique though different morphologies are reported as abnormalities by Archer (1975b).

Detailed comparisons with *P. otibandus* will have to await formal description of the Bluff Downs material. Plane (1972) and Bartholomai (1973) indicate broad similarities between *P. otibandus*, *P. devisi* and *P. chinchillaensis*, and the apparently long geological history of at least *P. otibandus*, from late Miocene to late Pliocene time.

Macropus sp. cf. M. dryas (De Vis, 1895)
(Plate 57c–d)

This macropodid is well-represented by fragmentary dentaries (e.g. F7823), and maxillary fragments (e.g. F7780). F7823 closely resembles F2508 from Chinchilla which is referable to *M. dryas*. Differences include a slightly more massive P_3 which also lacks the prominent crest extending postero-lingually from the posterior end of the longitudinal crest; less antero-posteriorly oriented paracristid; narrower anterior cingulum on dP_4; and longer P_4 with fewer and less well-defined vertical ribs along the longitudinal crest. These differences appear reasonably constant in all specimens examined. Upper teeth also resemble *M. dryas*, and no consistent differences have been noted in premolar or molar morphology.

Macropus (Osphranter) sp., cf. M. woodsi Bartholomai, 1975
(Plate 57e)

F7785, an isolated RM^x represents a species of *Macropus* morphologically similar to *Macropus (Osphranter) pan* and *woodsi* from the Chinchilla Sand. It is approximately the size of *M. woodsi* and smaller than *M. pan*. Characters that suggest relationship with these Chinchilla species include a prominent isolated enamel crest or cusp buccal to the midlink in the buccal side of the mid-valley; relatively narrow anterior cingulum with forelink; midlink without accessory crests; and well-developed posterior pocket. This Allingham form, at present known from one tooth, could well prove to be an ancestor of either *Macropus woodsi*, *M. pan* or both.

Three isolated premolars (F7789–91) resemble those of modern *M. (Osphranter)* but may represent either *M. (Osphranter)* cf. *M. woodsi*, or yet another unknown, even unrelated, macropodid. An unworn LP^4 (F7791) shows a basic pattern

shared by many macropodine genera such as *Macropus*, *Petrogale*, *Prionotemnus*, and *Wallabia*, with a principal longitudinal ribbed crest supported at each end by a large cusp; well-developed lingual cingulum and cingular basin; low postero-lingual cusp connected to the longitudinal crest by a small transverse crest; and small posterior pocket formed between the transverse crest, the postero-lingual cusp, the large posterior cusp of the longitudinal crest, and a small posterior cingulum. A slightly worn LP_4 is more similar to that tooth in *Osphranter* than other forms examined. It is a simple tooth, indistinctly bilobed with a very reduced postero-lingual crest.

Cf. Thylogale

Two isolated lower molars (F7794–5) are difficult to distinguish from teeth of modern *Thylogale* but show too few distinctive structures to enable reference to any particular modern or fossil genus.

An isolated upper right molariform tooth (F7785) may represent a dP^4 and is similarly difficult to distinguish from corresponding teeth of *Thylogale* (e.g. *T. stigmatica*).

SMALL MACROPODINE
(Plate 57f)

F7784, an isolated lower molar, is unlike other Allingham macropodids noted above in possessing a relatively horizontal posterior cingulum, such as occurs in some *Protemnodon*. This feature combined with its *Macropus*-like crown morphology and small size makes it unlike any Pliocene or Quaternary macropodids examined.

DIPROTODONTIDAE

Zygomaturus sp.
(Plate 58d)

An isolated RP^4 (F7776) represents a species of *Zygomaturus*. Three species of *Zygomaturus* are currently recognized: *Z. trilobus* (many Pleistocene deposits); *Z. gilli* (Beaumaris); and *Z. keanei* (Alcoota). The Allingham *Zygomaturus* differs from all of these in having a much larger hypocone and smaller protocone so that transverse tooth width is markedly greatest along a line through the hypocone and metacone, and a much better developed buccal cingulum and cingular pocket.

Closer comparison may be made with an as yet undescribed specimen (F3829) of *Zygomaturus* from the Chinchilla Sand. The Chinchilla specimen is similar in having a large hypocone and a well-developed buccal cingulum. It differs from the

Allingham tooth in being much larger in all dimensions; in having an even longer buccal cingulum; and in having the protocone and hypocone farther apart. Other differences are obscured by wear on the Allingham specimen.

This zygomaturine is important first in suggesting a closer relationship with a Chinchilla species than any other zygomaturine, and secondly in demonstrating differences which may be interpreted as indicating it could be ancestral to the Chinchilla species.

The importance of zygomaturines in correlation has been suggested by Stirton, Tedford and Woodburne (1968), and they may be useful in interpreting the age of the Chinchilla Sand relative to other late Tertiary mammal bearing deposits.

Euryzygoma sp.
(Plate 58a)

The most common diprotodontid from the Allingham Formation is referable to the nototheriine genus *Euryzygoma*. Only one species is named, *E. dunense*, from the Chinchilla Sand.

The Allingham *Euryzygoma* is represented by one complete (F7891) and two partial skulls as well as several dentaries and isolated teeth. If it were not for the enormous variation apparently exhibited by *E. dunense* from Chinchilla, it would be tempting to believe that more than one species was represented by the Allingham remains. This may yet prove to be the case. The possibility that there is more than one Chinchilla species is also under examination. Until this problem is resolved, the specific identity of the Allingham *Euryzygoma* must remain uncertain.

Although premolar morphology can be matched in the two samples (e.g. F7765 from Allingham, and some of the teeth included in F5812 from Chinchilla), several cranial differences include morphology of the zygomatic arch which in the Allingham *Euryzygoma* more closely resembles less specialized nototheriines than does *E. dunense*.

NOTOTHERIINE, genus indet.
(Plate 58b–c)

A small nototheriine is represented by several dentary fragments including F7766, an isolated worn RP[4]; F7830, a maxillary fragment of an as yet unprepared skull containing M[3–4]. This animal differs from the Allingham *Euryzygoma* in being much smaller, having a very reduced M[4] with markedly narrow metaloph, and in several characters of the dentary.

It resembles in molar and dentary morphology several specimens from Chinchilla regarded previously as *Euowenia grata*, a form whose generic

status is in doubt. M[4] of F519 (holotype of *Euowenia grata*) from Chinchilla is similar but has a wider metaloph than the Allingham specimen.

Taxonomic assessment of this small Allingham nototheriine will have to await preparation of the skull.

INCERTAE SEDIS
(Plates 55d–f, 57g)

A single tooth fragment (F7792) may represent an otherwise unknown family. It represents a medium to large-sized animal, presumably marsupial, that has a well-developed cingulum, and at least two small twinned cusps. Twinned cusps are rare in marsupials. They occur in some perameloids (e.g. *Macrotis*) and phascolarctids.

Coprolites (e.g. F7761) are common in the deposit. Size and shape suggest they were produced by a medium to large-sized animal, possibly a corcodilian, large snake, or diprotodontid, and that they were deposited in water. Some of the largest are too massive to have maintained their shape had they been deposited on hard ground or transported. Further, they bear no impressions such as might be expected if they were deposited on an irregular terrestrial surface.

DISCUSSION

At this stage in our knowledge of the Bluff Downs local fauna, twenty-two taxa including thirteen mammals have been recognized. There is no representation of monotremes, dasyurids, thylacinids, thylacomyids, phalangerids, petaurids, burramyids, myrmecobiids, wynyardiids, notoryctids, or tarsipedids. Except for the last four, all are represented in older as well as younger deposits and their absence from the Bluff Downs local fauna cannot be the result of absence from the Australian continent at that time. In some families, representative modern forms occur in most broad ecological habitats so that absence of monotremes, dasyurids, petaurids, and burramyids may be the result of chance sampling. Notoryctids, myrmecobiids and thylacomyids are represented in the modern fauna by arid-adapted forms, most of which are rare, and their absence from the Bluff Downs local fauna may reflect a similar Pliocene rarity or an unsuitable environment.

ASPECTS OF THE PALAEOENVIRONMENT

Accuracy of interpretation depends on both extent to which the sample represents the contemporaneous fauna in diversity and species abundance, and extent that ecological requirements of

fossil forms may be interpreted from those of their nearest living relatives. Major uncertainties remain.

Certainties are that *Chara*, crustaceans, and fish indicate persistent fresh water, and tortoises, crocodiles and Black-headed Storks are supporting evidence for at least seasonal bodies of water. Modern tortoises and crocodiles can migrate considerable distances to find suitable water and therefore are not evidence for permanent water. When the modern Allingham Creek is running, small fish are abundant and tortoises common. When the creek is not running tortoises form a relatively much larger part of the biomass in waterholes (pers. comm. J. Barratt), presumably a reflection of their ability to migrate.

Among carnivores known from the fossil fauna, the dog-sized *Thylacoleo* is the largest mammalian carnivore. The crocodile *Palimnarchus* was probably capable of killing any of the mammals represented in the fauna. Although tortoises could have formed at least part of the food supply of *Palimnarchus*, not one of the hundreds of plates preserved show evidence of tooth marks which would suggest such predation. Further, there are very few fish remains in the deposit, suggesting they were not an abundant source of crocodile food. It is possible that *Palimnarchus* hunted mainly mammals (and/or birds), either waiting for them to come to water, or possibly even pursuing them near shore.

Mammals represented in the deposit suggest arboreal *(Koobor jimbarratti)* as well as terrestrial habitats. The much greater abundance of terrestrial forms suggests that the surrounding area was savannah woodland. Terrestrial forms include numerous grazing kangaroos and diprotodontids, including a species of *Protemnodon* which may have been a browser. There is evidence from macropodid post-cranial remains of a Tree Kangaroo-like form which may have been the same species of *Protemnodon*. Considering the apparently rapid evolution and radiation of kangaroos in the late Tertiary (Bartholomai 1972), it is perhaps particularly unwise to extrapolate to these lower Pliocene forms, habitat requirements of supposedly similar modern forms. Thus, *Macropus (Osphranter) cf. M. woodsi* may not resemble most modern members of the subgenus *Osphranter* in showing any preference for rocky hills or slopes.

In summary, there is evidence to suggest that bodies of water were present for at least months at a time. It is also probable that these lakes, rivers, or swamps were not permanent. It is possible that the Bluff Downs local fauna represents a riparian assemblage.

COMPARISON WITH OTHER KALIMNAN AND POST KALIMNAN LOCAL FAUNAS

Comparisons of the Bluff Downs local fauna should be made with the Chinchilla, Hamilton, Awe, Fisherman's Cliff, Kanunka, Palankarinna, and Beaumaris local faunas. This comparison is summarized in Table 1 where only species occurring in the Bluff Downs local fauna are considered.

CHINCHILLA: Except for the peramelid, all Bluff Downs mammal species are closely comparable with forms from the Chinchilla local fauna of southeastern Queensland. Frequently the Bluff Downs member of each species pair is structurally ancestral in terms of size and morphology. For this reason, differences between the two local faunas are not regarded here as evidence of merely ecological or geographical differences, but rather as evidence for a difference in age, with Chinchilla appearing to be the younger of the two. We support the suggestion of Bartholomai (1973) of a late Pliocene age for Chinchilla. It is not likely to be Pleistocene because of the closer similarities of Chinchilla species to those of Bluff Downs than to those from eastern Darling Downs Pleistocene deposits. For example, there is no undoubted record of *Diprotodon*, *Nototherium*, *Procoptodon*, *Fissuridon*, *Macropus (Macropus)*, or *Sarcophilus* from Chinchilla or Bluff Downs, nor is there any record of *Euryzygoma*, *Macropus* cf. *M. dryas* or *Protemnodon* cf. *P. chinchillaensis* from eastern Darling Downs deposits.

HAMILTON: The Pliocene Hamilton local fauna of Victoria (Turnbull and Lundelius 1970) is not broadly comparable with either the Bluff Downs or the Chinchilla local faunas since it contains mostly small mammals represented by isolated teeth. Only *Palorchestes* near *P. painei* appears to suggest that Hamilton is structurally older than Chinchilla which contains *P. parvus*. Teeth from the Hamilton deposit came from a soil overlain by a basalt dated at 4.35 ± 0.1 Myr (Turnbull and Lundelius 1970). Therefore the Hamilton local fauna may be closely comparable in age to the Bluff Downs local fauna.

AWE: The Pliocene Awe local fauna of Papua (Plane 1967) contains two structurally simple species of *Protemnodon* and in this respect they resemble Bluff Downs and Chinchilla species. Awe zygomaturines (*Kolopsis rotundus* and *Kolopsoides cultridens*) are structurally more primitive than the Bluff Downs *Zygomaturus*, and clearly resemble late Miocene Alcoota zygomaturines. However, the Awe nototheriine (*Nototherium watutense*) is not very different from the Bluff Downs nototheriines (*Euryzygoma* and `*Euowenia*`). Lack of a

TABLE 1: The Distribution of Elements of the Bluff Downs Local Fauna in Other Late Tertiary and Early Quaternary Local Faunas

Bluff Downs local fauna	E. Darl. Downs	Kanunka	Fisherman's Cliff	Chinchilla	Hamilton	Awe	Palankarinna	Beaumaris
crustacean		s?					s?	
fish (teleost)	s?	s?	s?	s?			s?	
?*Chelodina* sp.	s?	s?	f?	s?				
Palimnarchus sp.		f		s?		f	f	
cf. *Amphibolurus* sp.								
Varanus sp.	s?	f		s?				
? elapid								
boid						s?		
Xenorhynchus asiaticus	c	c	c	c		c	c	
Perameles allinghamensis					g?		sf	
Phascolonus lemleyi	g	s?	f	g				
Koobor jimbarratti				g				
Thylacoleo sp.	g	g		g				
Protemnodon sp.	g	s?	g	g		s?	g	
M. (Prionotemnus) cf. *M. dryas*	sg	sg	sg	s?			sg	
M. (Osphranter) cf. *M. woodsi*	sg		sg	s?				
small macropodid, cf. *Thylogale*				s?				
small macropodid, gen. indet.								
Zygomaturus sp.	g	g?	g	s?		sf	g	g
Euryzygoma sp.				g				
nototheriine, gen. indet.	g?	g		s?		sf	sf	
Maximum number of mammal species in common	0	2?	0	4?	2?	0	0	0

Abbreviations: s, either same species or else not yet demonstrated to be a different species; sg, same subgenus; g, same genus but different species; sf, same subfamily; f, same family; c, same class.

premolar referable to *N. watutense* prohibits close comparison, but it is clear that all three forms are broadly similar. Anderson (1937) compares the holotype with known nototheriines and concludes it is closest in size to *Euowenia grata*. Considered as a whole, the Awe zygomaturines suggest that the Awe local fauna is structurally older than the Bluff Downs local fauna although Page and McDougall (1972) suggest that a date of 3·1 Myr may be the oldest reliable date associated with the Awe local fauna. Plane (1967) reports dates between 5·7 and 7·6 Myr for intercalated pyroclastics.

FISHERMAN'S CLIFF: Marshall (1973) regards the Fisherman's Cliff local fauna to be probably late Pliocene or early Pleistocene in age. The macropodids include a species of *Protemnodon* which Marshall considers is most similar to *P. devisi* (as *P.* cf. *P. otibandus*) from Chinchilla. The specimen is not figured. The diprotodontids include a possible species of *Diprotodon* which suggests this local fauna is Pleistocene in age.

KANUNKA: The Kanunka local fauna from the Lake Eyre Basin of South Australia is briefly described by Stirton, Tedford and Miller (1961) who consider it to be ?Pleistocene in age. Their preliminary comments suggest similarity to the Bluff Downs local fauna, but do not exclude comparison with Pleistocene deposits such as those from the eastern Darling Downs. The apparent absence of *Diprotodon* favours a late Pliocene age, although it is probably younger than the Bluff Downs or Chinchilla local faunas.

PALANKARINNA: Stirton, Tedford and Woodburne (1968) regard the Palankarinna local fauna from the Lake Eyre Basin of South Australia to be late Pliocene in age. Faunal diversity is low. The perameloid (*Ischnodon australis*) is a thylacomyid and hence not comparable with *Perameles allinghamensis*. Diprotodontids include the nototheriine *Meniscolophus mawsoni* and the zygomaturine *Zygomaturus keanei*. It is apparent that generic boundaries of *Meniscolophus*, *Euryzygoma* and '*Euowenia*' need re-examination. However, *M. mawsoni* appears to differ specifically from Chinchilla and Bluff Downs nototheriines. *Z. keanei* and the *Zygomaturus* from Bluff Downs differ at

what is probably a specific level, but it is not yet possible to assess which form is structurally ancestral to the other. Bartholomai (1975) has recently recognized the Palankarinna macropodid *Prionotemnus palankarinnicus* from Chinchilla.

BEAUMARIS: Stirton, Tedford and Woodburne (1968) review the Beaumaris local fauna from southern Victoria, considering it to be early Pliocene in age. *Zygomaturus gilli* is, like *Z. keanei* and *Z. trilobus*, unlike the Bluff Downs *Zygomaturus* which resembles, but differs from. the Chinchilla *Zygomaturus*. Zygomaturine taxonomy and biostratigraphy is in need of careful re-examination and at this stage it does not enable us to assess the relative ages of the two local faunas.

In summary, the Bluff Downs local fauna compares most closely with the Chinchilla local fauna but may prove to be also similar in composition to the Kanunka and Hamilton local faunas. Apparent differences between these and other Kalimnan local faunas may be the result of differing ages, latitudes, conditions of accumulation, or ecological setting.

ACKNOWLEDGMENTS

LITERATURE CITED

ANDERSON, C., 1937. Palaeontological notes No. IV: Fossil marsupials from New Guinea. *Rec. Aust. Mus.* **20**: 73–6.

ARCHER, M., 1974. The development of the cheek-teeth in *Antechinus flavipes* (Marsupialia, Dasyuridae). *J. Roy. Soc. West. Aust.* **57**: 54–63.

1975a. The development of premolar and molar crowns of *Antechinus flavipes* (Marsupialia, Dasyuridae) and the significance of cusp ontogeny in mammalian teeth. *J. Roy. Soc. West. Aust.* **57**: 118–25.

1975b. Abnormal dental development and its significance in dasyurids and other marsupials. *Mem. Qd Mus.* **17**: 251–65.

BARTHOLOMAI, A., 1972. Aspects of the evolution of the Australian marsupials. Presidential address. *Proc. R. Soc. Qd* **83**: v–xviii.

1973. The genus *Protemnodon* Owen (Marsupialia: Macropodidae) in the upper Cainozoic deposits of Queensland. *Mem. Qd Mus.* **16**: 9–23.

1975. The genus *Macropus* Shaw (Marsupialia: Macropodidae) in the upper Cainozoic deposits of Queensland. *Mem. Qd Mus.* **17**: 195–235.

DE VIS, C. W., 1894. The lesser chelonians of the Nototherian drift. *Proc. R. Soc. Qd* **10**: 123–7.

1895. A review of the fossil jaws of the Macropodidae in the Queensland Museum. *Proc. Linn. Soc. N.S.W.* **10**: 75–133.

1897. The extinct fresh-water turtles of Queensland. *Ann. Qd Mus.* **3**: 3–7.

1889. On the phalangistidae of the post-Tertiary period in Queensland. *Proc. R. Soc. Qd* **6**: 105–14.

EXON, N. F., LANGFORD-SMITH, T., and McDOUGAL, I., 1970. The age and geomorphic correlations of deep-weathering profiles, silcrete, and basalt in the Roma region, Queensland. *J. Geol. Soc. Aust.* **17**: 21–30.

FEJÉRVÁRY, G. J., 1918. Contributions to a monography on fossil Varanidae and on Megalanidae. *Ann. hist.-nat. Mus. Hungar.* **16**: 341–467.

HARLAND, W. B., GILBERT SMITH, A., and WILCOCK, B., 1964. The Phanerozoic time scale. Supplement to *Q. Jl Geol. Soc. Lond.* **120S**: i–viii, 1–458.

LONGMAN, H. A., 1924. Some Queensland fossil vertebrates. *Mem. Qd Mus.* **8**: 16–28.

LYDEKKER, R., 1887. 'Catalogue of the fossil mammalia in the British Museum (Natural History).' Part V (Marsupials, 146–289). (British Museum (Natural History): London).

MARSHALL, L. G., 1973. Fossil vertebrate faunas from the Lake Victoria region, S.W. New South Wales, Australia. *Mem. Nat. Mus. Vict.* **34**: 151–72.

MERRILEES, D., 1968. Man the destroyer: late Quaternary changes in the Australian marsupial fauna. *J. Roy. Soc. West. Aust.* **51**: 1–24.

OWEN, R., 1872. On the fossil mammals of Australia (Part vi): Genus *Phascolomys*, Geoffr. *Phil. Trans.* **1872**: 173–96.

PAGE, R. W., and McDOUGALL, I., 1972. Ages of mineralization of gold and porphyry copper deposits in the New Guinea highlands. *Econ. Geol.* **67**: 1034–48.

PLANE, M. D., 1967. Stratigraphy and vertebrate fauna of the Otibanda Formation, New Guinea. *Bur. Min. Resour. Aust. Bull.* **86**: i–vi, 1–64.

— 1972. A New Guinea fossil macropodid (Marsupialia) from the marine Pliocene of Victoria, Australia. *Mem. Nat. Mus. Vict.* **33**: 33–6.

RIDE, W. D. L., 1967. On *Sceparnodon ramsayi* Owen, 1884: The selection of a lectotype, the clarification of its type locality, and on its identity with *Phascolonus gigas* (Owen, 1859). *Rec. S. Aust. Mus.* **15**: 419–25.

— 1970. 'A guide to the native mammals of Australia.' Pp. xiv + 249 (Oxford Univ. Press: Melbourne).

RIEDEL, W. R., 1973. Cenozoic planktonic micropaleontology and biostratigraphy. *Ann. Rev. Earth and Plan. Sci.* **1**: 241–68.

ROBERTS, A., and MOUNTFORD, C. P., 1970. 'The Dreamtime'. 79 pp. (Rigby Ltd.: Adelaide).

STEPHENSON, N. G., 1964. On fossil giant wombats and the identity of *Sceparnodon ramsayi. Proc. Zool. Soc. Lond.* **142**: 537–46.

STIRLING, E. C., 1913. On the identity of *Phascolomys (Phascolonus) gigas,* Owen, and *Sceparnodon ramsayi,* Owen; a description of some of its remains. *Mem. Roy. Soc. S. Aust.* **1**: 127–78.

STIRTON, R. A., 1955. Late Tertiary marsupials from South Australia. *Rec. S. Aust. Mus.* **11**: 247–68.

— 1967. A new species of *Zygomaturus* and additional observations on *Meniscolophus,* Pliocene Palankarinna fauna, South Australia. *Bur. Min. Resour. Aust. Bull.* **85**: 129–47.

STIRTON, R. A., TEDFORD, R. H., and MILLER, A. H., 1961. Cenozoic stratigraphy and vertebrate paleontology of the Tirari Desert, South Australia. *Rec. S. Aust. Mus.* **14**: 19–61.

STIRTON, R. A., TEDFORD, R. H., and WOODBURNE, M. O., 1968. Australian Tertiary deposits containing terrestrial mammals. *Univ. Calif. Publ. Geol. Sci.* **77**: 1–30.

TATE, G. H. H., 1948. Studies in the Peramelidae (Marsupialia). *Bull. Am. Mus. nat. Hist.* **92**: 313–46.

— 1951. The wombats (Marsupialia, Phascolomyidae). *Amer. Mus. Novit.* **1525**: 1–18.

TEDFORD, R. H., 1970. Principles and practices of mammalian geochronology in North America. *Proc. N. Amer. Paleon. Conv., Sept., 1969*: 666–703.

TURNBULL, W. D. and LUNDELIUS, E. L., 1970. The Hamilton fauna, a late Pliocene mammalian fauna from the Grange Burn, Victoria, Australia. *Fieldiana: Geol.* **19**: 1–163.

WAKEFIELD, N. A., 1972. Palaeoecology of fossil mammal assemblages from some Australian caves. *Proc. R. Soc. Vic.* **85**: 1–26.

WORRELL, E., 1970. 'Reptiles of Australia'. Pp. xv + 169. (Angus and Robertson: Sydney).

WYATT, D. H., 1968. Townsville, Qd. 1:250,000 Geological Ser. Explan. Notes Bur. Miner. Res. Geol. Geoph. Aust., SE/55–14.

— 1969. A note on the geology of the Bluff Downs–Allensleigh area. *Qd. Govt. Min. J.* **17**: 296–303.

WYATT, D. H., and WEBB, A. W., 1970. Potassium-argon ages of some northern Queensland basalts and an interpretation of late Cainozoic history. *J. Geol. Soc. Aust.* **17**: 39–51.

PLATE 54

Bluff Downs invertebrates and lower vertebrates
a, F7772 teleost vertebra
b, F7771, teleost spine
c, F7767, vertically fluted crocodile tooth
d, F7763, tooth of *Palimnarchus* sp.
e, F7764, tooth of *Palimnarchus* showing occlusal wear of tip
f, F7829, crustacean gastrolith
g, F7826, small snake vertebra, possibly elapid
h, F7813, tooth possibly referable to *Varanus* sp.
i, F7812, fragment of an agamid dentary
j, F7774, vertebra of *Varanus* sp.
k, F7775, vertebra of a large boid
Unless otherwise indicated, line represents one cm.
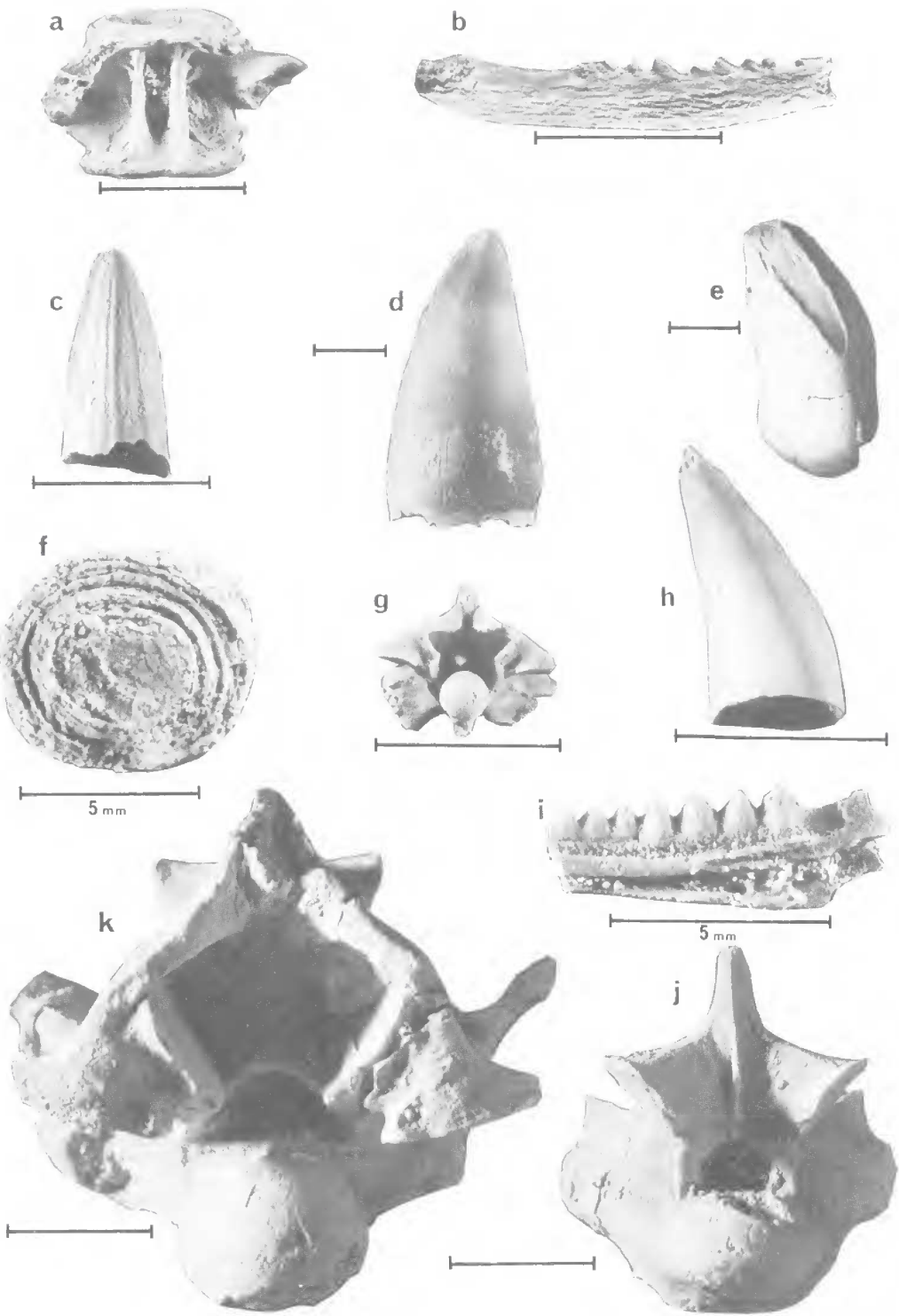
PLATE 54

PLATE 55

Bluff Downs mammals

a, F7762, right dentary of *Thylacoleo* sp. with broken P_4 and M_1

b, F7822, stereopair scanning electron microscope photographs, RM^1 or RM^2, holotype *Koobor jimbarratti* n. gen. and sp.

c, F7821, stereopair scanning electron microscope photographs, RM^2, holotype *Perameles allinghamensis* n. sp.

d–f, F7792, stereopair, tooth fragment of unknown type of mammal
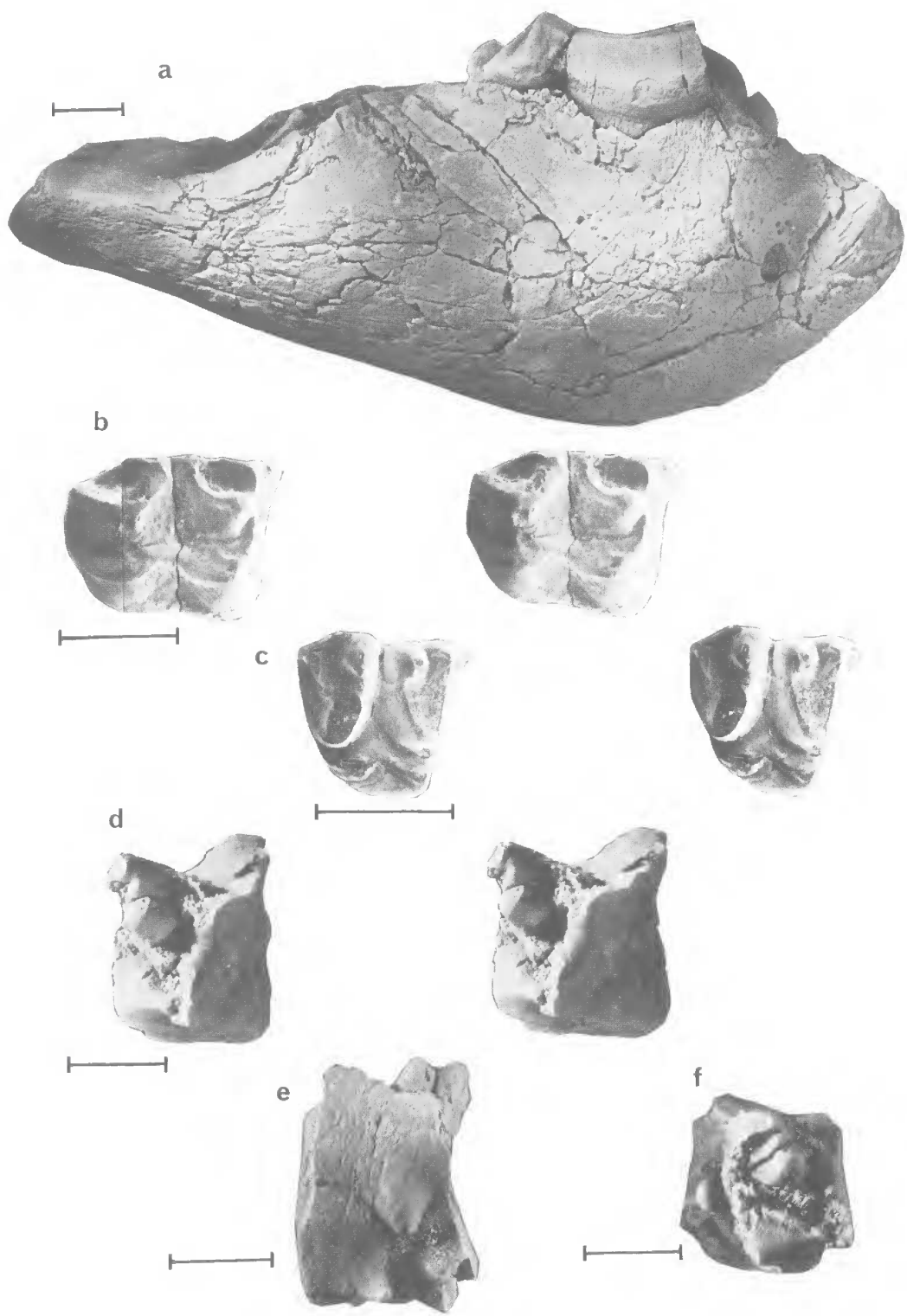
Line represents one cm.

PLATE 55

PLATE 56

Phascolonus lemleyi n. sp.
a, F7818, LI$_1$, lingual view
b–d, F7819, left dentary, holotype, *Phascolonus lemleyi* n. sp.
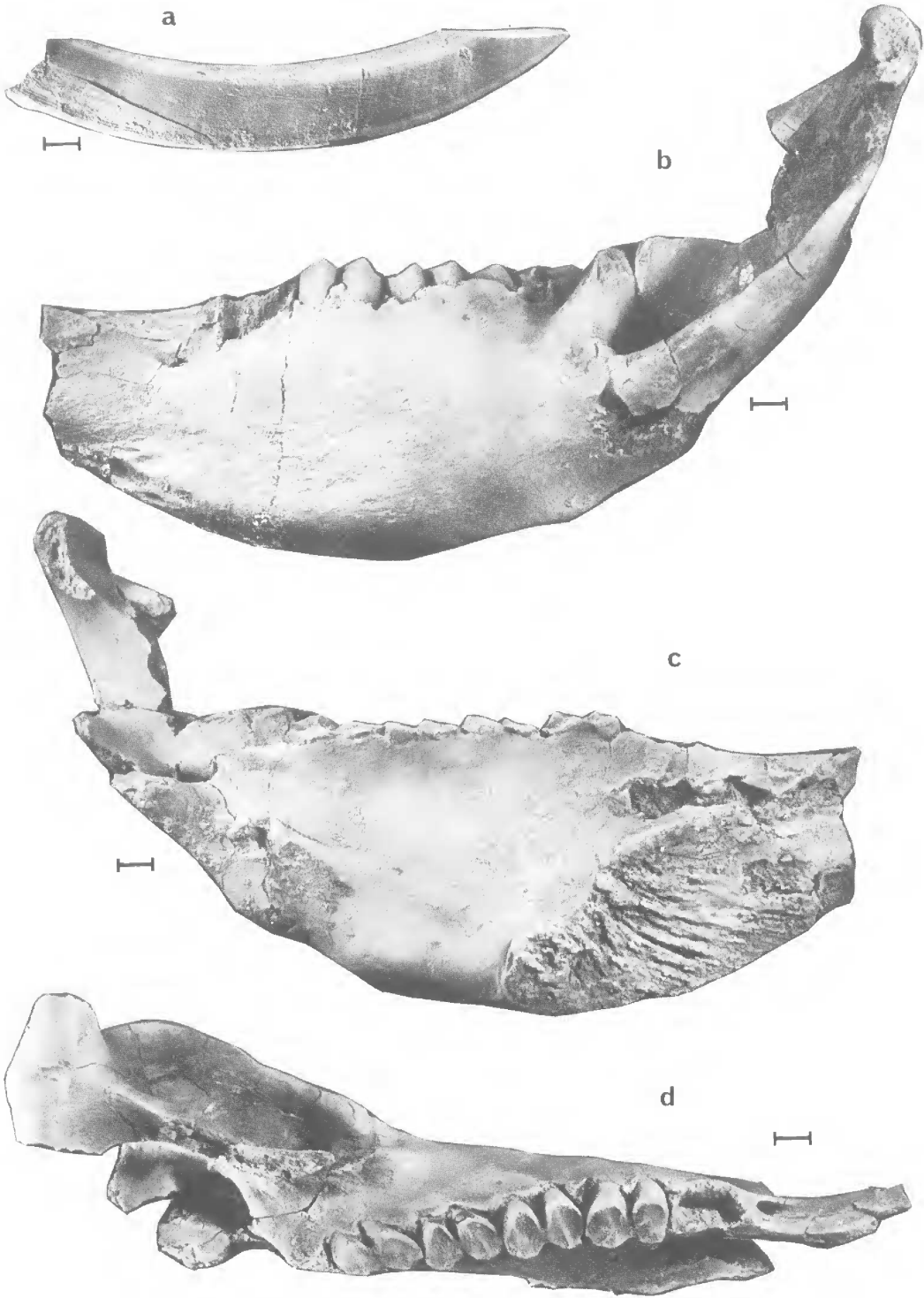Line represents one cm.

PLATE 56

PLATE 57

Bluff Downs macropodids and coprolite

a, F7810, right maxillary fragment with parts of RM^{1-2} and M^{3-4}, *Protemnodon* sp.

b, F7812, right dentary fragment with $RdP_4 - M_1$, *Protemnodon* sp.

c–d, F7823, right dentary with RP_3, dP_4, M_1, and P_4 (excavated, d), *Macropus* sp. cf. *M. dryas*

e, F7785, isolated upper molar, *Macropus (Osphranter)* sp., cf. *M. woodsi*

f, F7784, isolated lower molar, small macropodine of uncertain affinities

g, F7761, coprolite

Line represents one cm.

PLATE 57
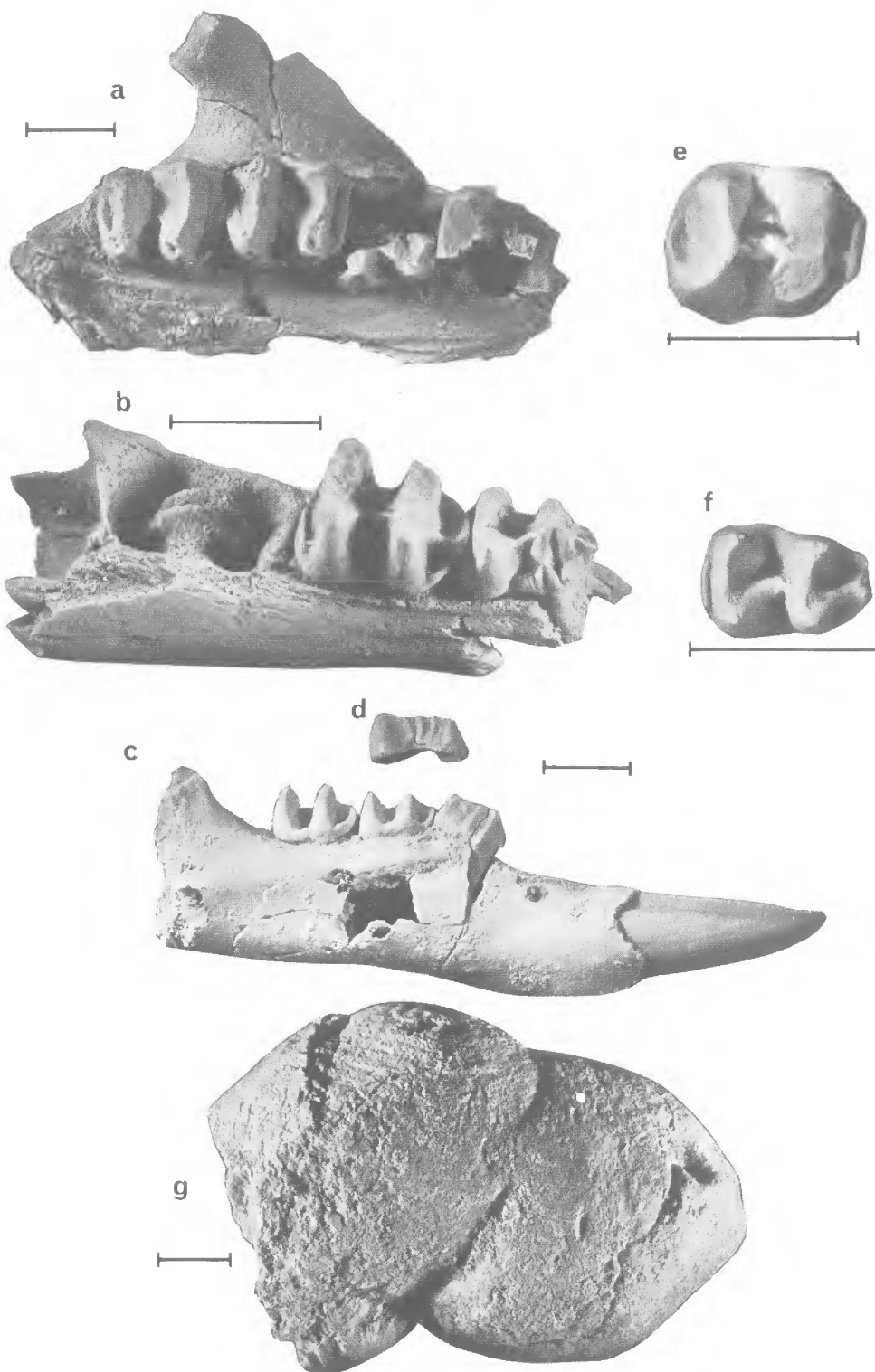
PLATE 58

Bluff Downs diprotodontids

a, F7891, skull, *Euryzygoma* sp.

b, F7830, left maxillary fragment, small nototheriine

c, left dentary fragment with damaged LM_{2-4}, small nototheriine

d, F7776, isolated RP^4, *Zygomaturus* sp.

Line represents one cm.

PLATE 58